



# Locate Errors and Eliminate Failures



**ibaPDA-PLC-Xplorer**  
Measuring from the beginning



**ibaAnalyzer**  
Powerful analyzing and  
evaluating of measured data

**Area of application: Troubleshooting**

Understanding plants - Avoid errors

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# Understanding plants - Avoid errors

Failures in automated plants lead to production downtimes and products of poor quality. Thus, it is extremely important to find these failures. In case of failure, the maintenance technician needs to have access to the measurement data which have been recorded during the disturbance. By analyzing these data, the technician finds the cause and eliminates the failure in the plant in a targeted way.

## Relevant data must be at hand

In order to be able to conclusively analyze failures in a production plant, relevant data from the controller must be available at the time when the failure occurs. They give insight into the dynamic behavior of the PLC and help answering the following questions: How are processes in a plant connected? What is eventually the root cause of a failure? Is it a systematic or sporadic error?

When the correlations are understood, the control program can be optimized to prevent future errors and ultimately to improve the process.

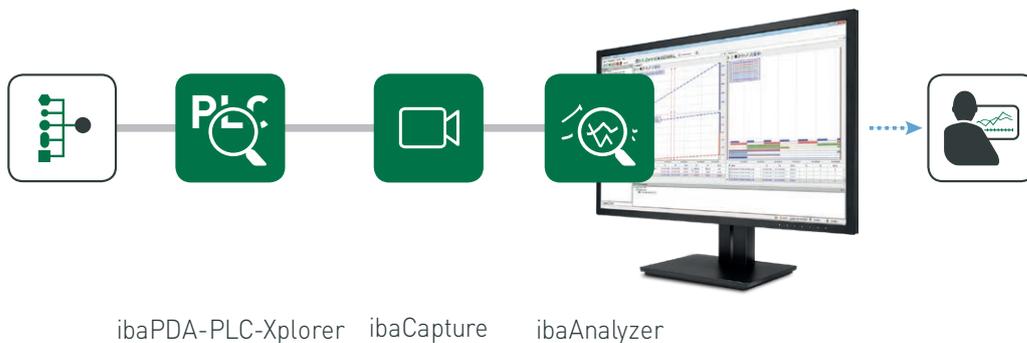
## The iba method

The iba error analysis method is based on a two-step process: First, the data from the PLCs are recorded synchronously and visualized online. In the second step, the analysis of the recorded data is performed. The analysis can already be performed parallel to the next recording.

ibaPDA-PLC-Xplorer is used for data acquisition and the free ibaAnalyzer for data analysis. The license for ibaAnalyzer is free of charge for the analysis of measurement files that are measured with an iba system, e.g. ibaPDA-PLC-Xplorer.

## Benefits

- › Systematic acquisition of complex processes
- › Increase plant availability by quickly locating failures
- › Root cause analysis and prevention of system errors
- › Process optimization



# Simple and cost-effective coupling to different PLCs

With ibaPDA-PLC-Xplorer, signals from different PLC systems can be acquired and recorded easily and at a very low cost level. Xplorer interfaces are available for the following PLCs: CODESYS-based systems, SIMATIC S7-, Allen-Bradley-, Beckhoff-, B&R-, Logix-, SIG-MATEK- and Mitsubishi PLCs.

Without additional hardware, ibaPDA-PLC-Xplorer generally allows access to the controllers via standard network boards and TCP/IP. Internal data of the PLC can be freely selected. Access to the PLC is completely transparent. Modifying the configuration of the PLC is just as unnecessary here as programming. Measurement values can be flexibly changed at any time while the system is still running.

The PLC interfaces in the Xplorer can be combined as desired. For instance, in larger, complex plants where multiple PLCs are interacting, data from the different PLCs can be acquired time-synchronously.

## Conveniently select measurement values

The selection of the measurement values is very simple. Via an integrated symbol browser, variables can be conveniently selected by mouse click as a symbol. In S7 systems, the symbol information can be read from the PLC and selected in a so-called address book. The address book can be generated in ibaPDA-PLC-Xplorer from the project files with just a mouse click.

## Recording when errors occur

The measurement data can be recorded on a time or event basis. In practice, the plants are continuously monitored whereas the data is "stored" in a buffer. The data is not recorded until a particular event, i.e. an accident occurs. For this purpose, possible error conditions are configured as triggers. If an error condition occurs, the signals are recorded with adjustable pre and post trigger time. This also allows the history of a failure to be accurately understood and analyzed. For instance, when interactions

of other signals in this process cause a failure. Another trigger signal can end the recording.

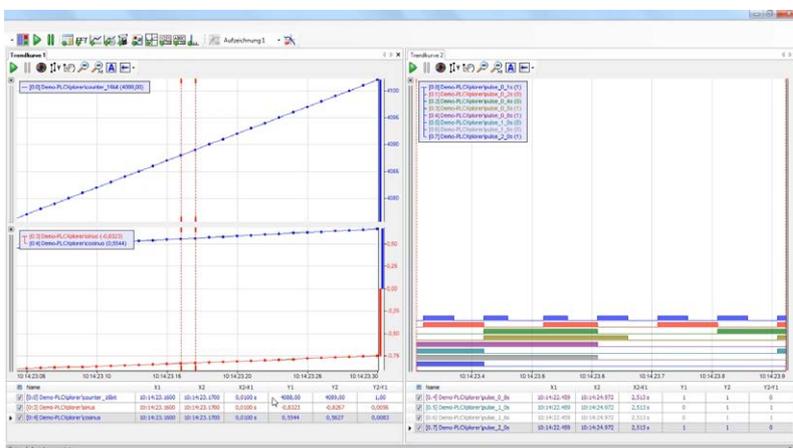
Trigger conditions can be configured with all analog and digital signals, combinations of multiple signals, or virtual signals. With the trigger editor, trigger conditions can be defined quickly and easily.

## Online display

With the online trend view, the timing of the signals can be monitored live on one or more clients - for each client in their individual view. Thus, for instance, PLC programmers or service technicians can view the areas of interest to them - of course, also mobile with a laptop.

In addition to the real time signal curve, ibaPDA-PLC-Xplorer offers all display forms known from ibaPDA such as oscilloscope, FFT or digital display. Using the zoom and marker functions, the display can be enlarged and measured down to individual samples.

ibaPDA-PLC-Xplorer generates measurement files in iba for-



Online display of signals: Associated signals are displayed in a trend graph and can be accurately measured with markers on the sample.

# Including free analysis

mat (\*.dat), which can then be evaluated with ibaAnalyzer.

Since data collection and analysis are separate, analysis can already be performed during recording or at a later time, such as by experts remote from the facility. ibaAnalyzer can run on several computers, so that multiple users can analyze the data individually. The data can centrally be stored on a server or sent by e-mail.

## Problem-specific analysis

The analysis can be performed according to individual, problem-oriented aspects.

ibaAnalyzer offers extensive mathematical functions to calculate characteristic values, to quantify and statistically evaluate failures, etc. In addition, virtual signals can be created and used for further calculations and analyses.

The focus is not just on the signal that indicates the fault. It is also possible to recognize correlations with other signals and to draw conclusions about the root cause of the failure, for instance PLC errors, speed or temperature fluctuations.

## Analysis results

### within short time

Everything that belongs to an analysis is stored in an analysis file and can be recalled at any time. This includes the signal representation, additionally defined virtual signals and calculations, settings for printing or reporting, interfaces for further processing in databases, etc.

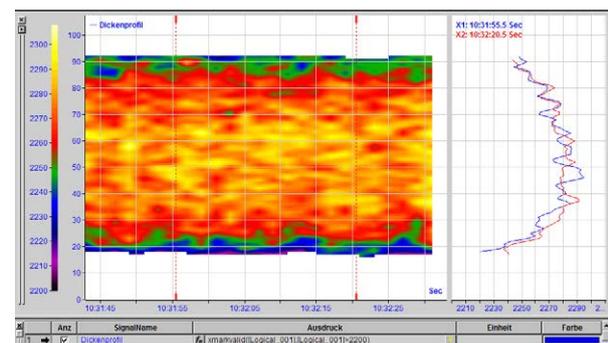
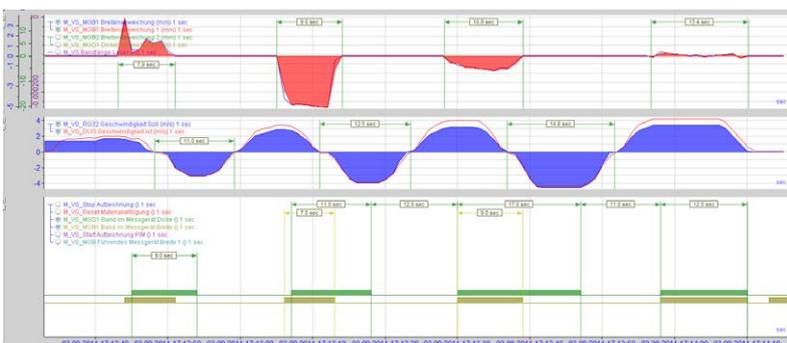
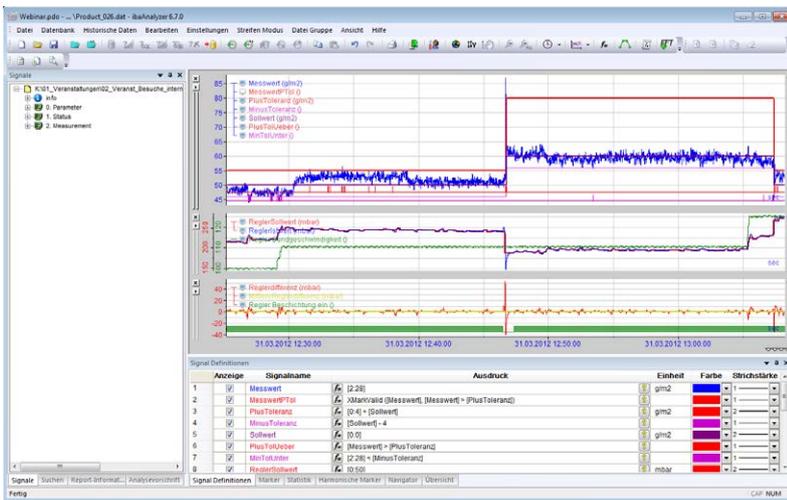
With the help of the analysis file, the evaluations can also be applied directly to all subsequent measurement files, allowing them to quickly identify trends over longer periods of time.

## Analysis and display functions for every purpose

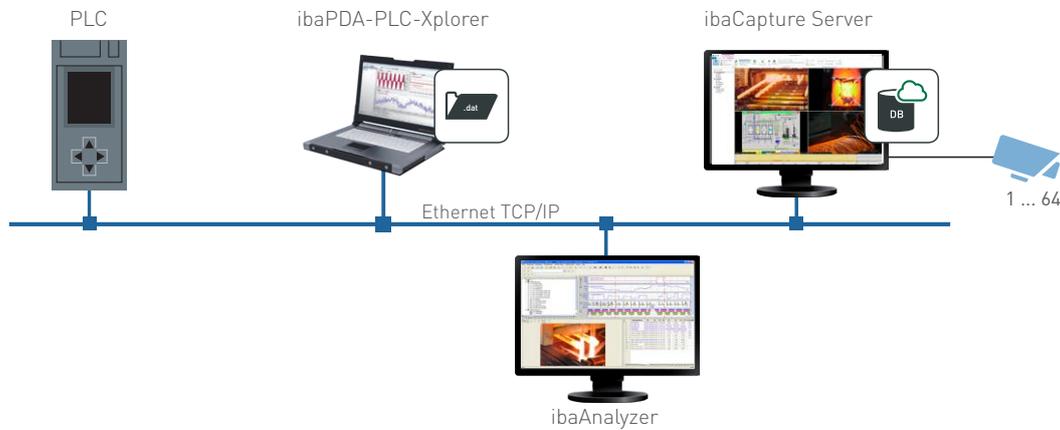
ibaAnalyzer offers the appropriate display function for every purpose. Limit values can be displayed in the time-related trend graph and their exceeding can be marked in color.

Example left: Trend views show signal curves, nominal values, tolerances, and limit violations in different colors

bottom left: Measuring analog and digital signals with a mouse click  
bottom right: 2D and 3D view of thickness profiles



# Video surveillance as supporting tool for error analysis



With ibaPDA-PLC-Xplorer and ibaCapture process data and video images can be recorded time-synchronously and be analyzed together in ibaAnalyzer.

In addition to displaying the signal curves in trend graphs, numeric displays are also available in tables. Numerous statistical functions enable statistical analyses virtually at the touch of a button. If a speed signal is available, the measured values can also be converted length-related.

In addition, ibaAnalyzer offers a series of FFT spectral analysis operations to analyze vibrations. The text function can be used to store additional information such as product or lot number, customer name or technological characterization etc. in the analysis.

## Video monitoring with ibaCapture

For metrics that can not be captured using traditional sensors, the support of video images is a valuable aid to analysis. This allows you to better understand relationships that are not recognizable only on the basis of measurement data. Errors can be recognized faster and root causes can be identified better.

With the video recording system ibaCapture, live images from video cameras are recorded synchronously to the measured values with ibaPDA-PLC-Xplorer. The measurement data from the process and the plant are linked in time with the video images. In the analysis, the images with the appropriate process signals can be viewed accurately to the sample.

Video recording requires an ibaCapture server license available in graduated steps and separate camera licenses. A solution with a connected camera is a convenient way to use video monitoring in addition to data acquisition.

## Connection to data base

If the data is to be processed in a database, ibaAnalyzer-DB allows the extraction of the measurement data into a database, but also the data analysis from a database. It supports the most common database formats, such as Microsoft SQL Server, Oracle, IBM DB2-UDB, MySQL, PostgreSQL, Microsoft Access.

# Automated post-processing and report generation

## Automated evaluation saves time

Once the requirements for the evaluation have been determined, the analysis can be automated. ibaPDA-PLC-Xplorer can be configured to automatically start an analysis of the last file.

Further support is offered by the applications ibaDatCoordinator and ibaAnalyzer-Reportgenerator. ibaDatCoordinator is a powerful tool for automating the processing and management of measurement data. For instance, the measurement data can be copied from the recording systems and be made available to all authorized persons at a central location.

## Reports at the push of a button

Reports in various formats and individual layouts can automatically be generated with ibaAnalyzer-Reportgenerator and sent by e-mail if desired. Individual order, shift or product reports for different departments such as production, quality management or controlling can be generated virtually at the push of a button.

## Licenses and extension to ibaPDA

The ibaPDA-PLC-Xplorer software package contains the data interfaces S7-Xplorer, AB-Xplorer, Codesys-Xplorer, Sigma-tek-Xplorer, Twincat-Xplorer, B&R-Xplorer, Logix-Xplorer and MELSEC-Xplorer and can

record a total of 64 analog or digital signals. If more than 64 signals or other add-ons are required, an upgrade to a complete ibaPDA system is possible at any time. With ibaPDA you can license additional features:

- › Number of signals (up to unlimited)
- › Extension of connectivity (further PLCs, Modbus, OPC UA, Generic TCP/UDP, etc.)
- › more than 2 data storages
- › more than 2 clients

The license for ibaAnalyzer is free for the analysis of measurement files created with a licensed iba software.

## Advantages at a glance

ibaPDA-PLC-Xplorer 	ibaAnalyzer 
<ul style="list-style-type: none"> <li>› No additional hardware required</li> <li>› Flexible, free access to internal PLC data</li> <li>› No configuration of the PLC program</li> <li>› Change measurement values during production</li> <li>› Time and / or event-related recording</li> <li>› Online visualization during measurement</li> </ul>	<ul style="list-style-type: none"> <li>› Problem-specific, interactive offline analysis</li> <li>› Automatic offline analysis and further processing</li> <li>› Calculation of characteristic values, signal connection</li> <li>› Evaluation by several people at the same time</li> </ul>

# Troubleshooting at a minesite

After a scheduled maintenance shutdown in an ore processing plant, the start-up of a certain process always resulted in a shutdown. The cause of the error could only be found when high-resolution data was acquired.

## The project

After a scheduled maintenance shutdown in an ore processing plant, the start-up of a particular sequence came to a grinding halt whenever a certain step in the sequence was reached. The plant operators could not determine the root cause of the problem, as their SCADA system was flooded with seemingly unrelated alarm messages when this sequence stop occurred.

A quick initial online monitoring of the S7 PLC by the site engineer also yielded no meaningful clue to the source of the problem.

## The technology

As an iba user, the site engineer quickly realized that it was time to start up ibaPDA-S7-Analyzer (today: ibaPDA-PLC-Xplorer). Due to symbol based S7 program integration, setup of the digital inputs and outputs that required monitoring was a cinch.

The Ethernet based acquisition times was then set to 10 ms to get a high resolu-

tion capture of the seemingly fleeting event. Then another start-up attempt was started.

As soon as the sequence crash occurred, the engineer took one look at the live data on his ibaPDA trend screen and immediately realized the root cause of the problem. The trend clearly showed that all previously active 24 V digital inputs dropped to zero a mere 150 ms after the sequence program gave the command to activate a particular digital output.

This "loss" of all the 24 V digital inputs led to the alarm flooding on the SCADA system and to an immediate abortion of the sequence by the PLC. Since this sequence stop also led to a deactivation of any associated digital outputs (including the one that "drained" the 24 V supply), all inputs became healthy again some 50 ms later.

As all of this happened in the blink of eye. It was impossible to observe it via traditional SCADA or S7 PLC online monitoring means.



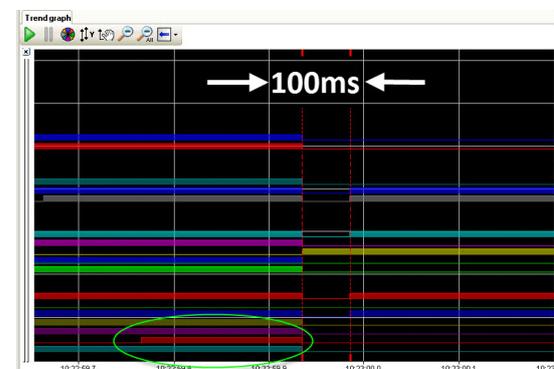
Efficient analysis of faults



High-speed data acquisition via Ethernet

Based on the ibaPDA captured data however, it was possible to determine the cause. As it turned out, the digital output in question activated a solenoid valve which had been immersed in water during maintenance work. This now created a partial short circuit which drained the 24 V supply.

It is estimated that this operation has saved many hours of unplanned plant downtime and the associated production downtime.



High speed ibaPDA fault capture trend of the S7 PLC's digital I/O's

# Packaging manufacturer reduces waste in gravure printing

A critical point in the printing process are the changes of the rolls. By detailed analysis of the processes in the printing press the produced waste could be reduced considerably.

## The project

Gravure printing is used for print jobs with a high edition of usually more than 300,000 copies. With the increasing competition on the market, the packaging manufacturers are constantly striving to enhance the efficiency of their plants, especially to reduce the set-up times and the waste. For this purpose, it is important to know and analyze exactly the processes running on the machine.

A critical point in the printing process are the changes of the rolls that are done as flying roll changes at full production speed - appr. 50 times a day. On the reel at the end of the printing line, an empty winding tube is accelerated on a second rewiner, until the circumferential speed of the tube matches the speed of the chilling line. The empty tube is stuck to the chilling paper web. Simultaneously, the printed roll is cut and ejected.

When changing the rolls, the web tension is of special importance.

The timing of acceleration of the shell, pressing and cutting must fit exactly. Fluctuations in web tension inevitably lead to a defective print image and hence waste that has been up to now always at 40 meters.

## The technology

Using the iba system, procedures and interactions, especially in the field of roll changes could be made visible and traceable. Optimizations in the hydraulics of the reel winding resulted in a considerable stabilization of the paper web tension. As a result, the waste is only 5 meters now.

## iba products

The measurement values are acquired and recorded with



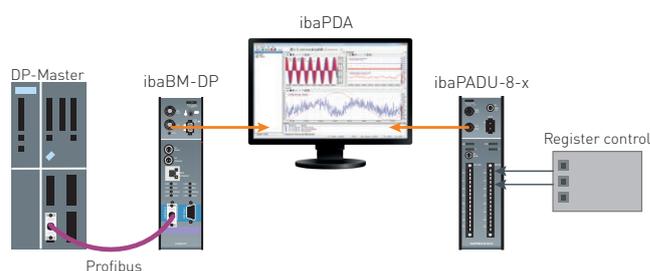
Immediate detection of deviations



Real-time monitoring

ibaPDA with a computer in the central server room.

ibaPADU devices convert  $\pm 10$ -Volt signals coming directly from the sensors and from the register controls at the printing machine into digital measured values. The Profibus-Sniffer ibaBM-DPM-S supplies data coming from the PLC of the machine. The register control of the gravure printing press is an autonomous control circuit whose analog signals are acquired time-synchronously with the data from the Profibus in ibaPDA. The analysis of the data showed that the adaptations in the hydraulics of the pressure roller ensured a better print image when changing the rolls. The waste could finally be reduced by 90%.



# Order information

## ibaPDA-PLC-Xplorer

Order no.	Name	Description
30.681502	ibaPDA-V7-PLC-Xplorer	ibaPDA system for 64 signals, 2 clients, 2 data stores, standard interfaces plus + S7-Xplorer (interface for SIMATIC S7) + AB-Xplorer (interface for Allen-Bradley) + B&R-Xplorer (interface for B&R systems) + Codesys-Xplorer (interface for CODESYS based systems) + Logix-Xplorer (interface for ControlLogix systems) + MELSEC-Xplorer (interface for Mitsubishi MELSEC systems) + Sigmatek-Xplorer (interface for SIGMATEK systems) + TwinCAT-Xplorer (interface for Beckhoff systems)
30.001900	Upgrade-ibaPDA-PLC-Xplorer-Interfaces	Upgrade of an existing license ibaPDA-PLC-Xplorer with the latest Xplorer interfaces
30.770009	Upgrade-PLC-Xplorer to PDA-V7-64	Upgrade to ibaPDA-V7 with 64 signals and PLC-Xplorer interface
31.001042	ibaPDA-Interface-PLC-Xplorer	Extension license for an ibaPDA system with PLC-Xplorer interfaces

## ibaCapture\*

Order no.	Name	Description
30.670210	ibaCapture-Server-60fps	Video recording for up to 60 fps, up to 8 client live-streams
30.670211	ibaCapture-Server-180fps	Video recording for up to 180 fps, up to 16 client live-streams
30.670220	ibaCapture-1CAM-REC	1 camera for recording and display
30.670221	ibaCapture-4CAM-REC	4 cameras for recording and display
30.670230	ibaCapture-1CAM-VIRT	1 virtual camera for recording and display of HMI or ibaVision images
30.670231	ibaCapture-4CAM-VIRT	4 virtual cameras for recording and display of HMI or ibaVision images

\*Additional licenses with a higher total frame rate (fps) are available for ibaCapture.

## Training

Order no.	Name	Duration
61.000200	Measurement and data evaluation with the iba system	2-day basic course
61.000500	Synchronous recording of video images and measurement data with ibaCapture	2-day basic course
61.100000	Measurement, data evaluation and automatic reporting with iba	3-day compact course





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